

Amendments to the Drawings

Please replace FIG. 1 as originally filed with the replacement FIGs. 1A and 1B enclosed herewith. Replacement figures 1A and 1B depict additional features of claimed embodiments of the invention, as requested by the Examiner, such as new and old generations

Remarks

In the Office Action mailed March 30, 2006:

1. The drawings were objected to under 37 CFR 1.83(a);
2. Claims 1-34 were rejected under 35 U.S.C. § 112 ¶ 1 as being based on a disclosure which is not enabling; and
3. Claims 1-34 were rejected under 35 U.S.C. § 102 as being anticipated by Jones (“Garbage Collection, Algorithms for Automatic Dynamic Memory Management”, 1996, pp. 126-131, 143-164).

I Drawings

Replacement FIGs. 1A and 1B are submitted to replace FIG. 1. FIG. 1A depicts a normal allocation phase in which window 110 defines a young generation and is slidable over memory 102. The window has upper bound 114 and lower bound 112, both of which slide as the window slides. A portion of memory behind or below the window defines the old generation.

FIG. 1B depicts a temporary allocation phase in which the lower bound of the window is fixed at a position at which short-lived data are stored or are to be stored. The upper bound of the window remains slidable to allow the window and young generation to expand.

Replacement FIGs. 1A and 1B now illustrate features of the claims that were not depicted in original FIG. 1. No new matter has been added. Description of the normal and temporary allocation phases may be found at, *inter alia*, page 4, line 26 to page 6, line 13.

II Rejections under 35 U.S.C. § 112 ¶ 1

The specification of the present application is asserted to be adequately enabling to one of ordinary skill in the art.

“The person of ordinary skill in the art is a hypothetical person who is presumed to be aware of all the pertinent prior art.” *Custom Accessories Inc. v. Jeffrey-Allan Indus.*, 807 F.2d 955, 1 USPQ 2d 1196, 1201 (Fed. Cir. 1986).

A specification may be enabling even though the invention is described using “broad terminology or illustrative examples.” *In re Wright*, 999 F.2d 1557, 27 USPQ 2d 1510, 1513

(Fed. Cir. 1993) (citing *In re Marzocchi*, 439 F.2d 220, 223, 169 USPQ 367, 369 (C.C.P.A. 1971)). Further, a specification that teaches how to make and use an invention in terms that correspond to the scope of the claims must be taken as complying with 35 USC § 112 ¶ 1 unless there is reason to doubt the objective truth of the statements relied upon for enabling support. *Staehelin v. Secher*, 24 USPQ 2d 1513, 1516 (BPAI 1992) (citing *In re Marzocchi*, 439 F.2d 220, 169 USPQ 367 (CCPA 1971)).

The Examiner specifically stated that “no data structures nor corresponding algorithmic steps considered necessary” to enable the making or use of the invention were provided. However, claim 21 is specifically directed to a data structure embodied in a computer readable medium. And, FIG. 2 depicts a number of operations that may be performed in order to accomplish a claimed method of Applicant’s invention.

“The amount of guidance or direction needed to enable the invention is inversely related to the amount of knowledge in the state of the art as well as the predictability in the art.” MPEP § 2164.03 (citing *In re Fisher*, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970)).

As the Examiner indicated by referring to the Jones reference (discussed below in Section III), the art of performing garbage collection in computer memory was mature at the time the present application was filed. Applicant thus asserts that one of ordinary skill in the art, at the time the application was filed and with knowledge of relevant prior art, would be able to construct any necessary data structures and derive a suitable algorithm for implementing the method of FIG. 2 based on the accompanying text (page 7, line 23 to page 10, line 4), without undue experimentation.

For example, FIG. 1 of the application depicts memory 102 with window 110 defined by an upper bound and a lower bound. The specification describes the manner in which the window “slides” over the memory, thereby identifying ever-changing portions of the memory as comprising a “young generation”. Applicant queries whether the Examiner is of the opinion that one of ordinary skill in the art would be unable to program a logical window that “slides” over a memory area.

Further, if the Examiner is of the opinion that Applicant has not enabled the operations of fixing a lower bound of the sliding window or allowing an upper bound of the sliding window to expand while the lower bound is fixed, this opinion would contrast with the allegation that Jones anticipates these features of Applicant’s invention. If Jones is believed to anticipate this subject

matter, then it must also be believed that such subject matter was known to one of ordinary skill in the art at the time the application was filed.

Thus, Applicant requests further identification of which elements or limitations in Applicant's claims are not enabled by the specification.

III Jones ("Garbage Collection, Algorithms for Automatic Dynamic Memory Management")

A. **Jones Does Not Contemplate Dynamic Sliding Segments**

In an embodiment of the invention, within a memory area subject to garbage collection, a dynamic sliding window is employed to define a young generation. In one phase of operation, the window "slides" within the memory area to encompass different portions of the area at different times. The window is "dynamic," in that one end of the window may be fixed at a particular location in the memory area while the other continues to move or slide.

In contrast, Jones does not disclose a dynamic window that slides, and one skilled in the art would not find it inherent in Jones to employ a dynamic sliding window.

The multi-area garbage collection schemes in Jones focus on garbage collecting an area and copying surviving data to another area (page 126, first paragraph of text). Jones' basic concept is described beginning on page 127 ("Incremental incrementally compacting garbage collection"), in conjunction with diagram 6.6.

In particular, the discussion surrounding diagram 6.6 teaches one to define $n+1$ distinct segments of equal size, at fixed locations. Garbage collection begins and surviving data are copied into segment i (the "Tospace") from segment $i+1$ (the "Fromspace"). Then segment $i+2$ can be garbage collected and surviving data copied into segment $i+1$, and so on. This same basic concept is followed in later portions of Jones.

For example, in another portion cited by the Examiner (diagrams 7.13 and 7.14), separate young and old generations are defined, with the young generation being logically divided into two spaces or buckets, a "New" space and an "Aging" space (page 160, second full paragraph of text; diagram 7.13). In diagram 7.14, the two spaces are not explicitly demarcated within the "young generation" area, but one encompasses the upper portion of the generation and another encompasses the lower portion.

As the carryover paragraph of pages 160-161 describes, garbage collection in the young

generation causes surviving data to be copied from one space to the other; diagram 7.14 illustrates this operation. Eventually, data to be promoted to the old generation are organized adjacent to the old generation and that data can be promoted by “moving the boundary between the two generations upward.”

The Examiner asserted that Jones’ disclosure “inherently” teaches that either the lower or upper bounds of a new generation may be fixed or allowed to dynamically expand. Applicant disagrees and, even if Jones *could* be interpreted as disclosing this explicitly or inherently, there is no suggestion or disclosure of combining this with a generation or window that slides. In fact, Jones could not work with a sliding window because the sliding window would conflict with Jones’ need for new generation segments of fixed size and fixed position.

The Examiner also referred to diagrams 7.4 and 7.12 – 7.15 of Jones, apparently for the proposition that Jones inherently discloses maintaining generational regions having various identified bounds within windowed range. However, those diagrams *also* fail to describe a sliding window. Diagram 7.4 (top) appears to illustrate the use of two fixed-size and fixed-position semi-spaces, and the garbage collection and copying of data between the two spaces. Diagram 7.4 (bottom) appears to illustrate the use of a single new generation area of fixed-size and fixed-position, and the copying of surviving data to an old generation. No sliding is depicted in diagram 7.4.

Diagram 7.12 appears to illustrate the use of a single fixed-size and fixed-position “creation space” and the use of two fixed-size and fixed-position “aging” semi-spaces. None of the spaces or semi-spaces appear to slide or expand. Diagrams 7.13 and 7.14 are addressed above.

Diagram 7.15 appears to illustrate fixed-size and fixed-position younger and next generations. The younger generation includes a single fixed-size and fixed-position creation space and two fixed-size and fixed-position semi-spaces.

Jones has been reviewed and no reference to a sliding generation or a window that slides over a generation could be located. This is not surprising because, as described above, Jones focuses on schemes in which fixed size memory areas are garbage collected and surviving data are copied to different areas. Even if Jones could be interpreted as suggesting the use of an expanding generational area, Jones could not be interpreted as suggesting having a window that, in different phases of operation, slides over a young generation and/or expands.

B. Jones Does Not Teach or Suggest Fixing a Lower Bound of a Slidable Window

In claimed embodiments of the present invention, a lower bound of a slidable window is fixed at a position in memory at which new data will be stored that is expected to become garbage in a short period of time.

As described above in Section III.A, Jones does not appear to contemplate the use of a sliding window encompassing newly stored data. Instead, Jones teaches the opposite – to use segments or spaces that are of fixed position and fixed size.

Therefore, it follows that one skilled in the art would not find in Jones a suggestion to fix a lower bound of a slidable window at a position at which data having a limited life would be stored.

C. Jones Does Not Teach or Suggest Dynamically Expanding an Upper Bound of a Slidable Window that has a Lower Bound Fixed in Place

In claimed embodiments of the present invention, a lower bound of a slidable window is fixed at a position in memory at which new data will be stored that is expected to become garbage in a short period of time, while an upper bound of the window is permitted to expand.

As described above in Section III.A, Jones does not appear to contemplate the use of a sliding window encompassing newly stored data. Instead, Jones teaches the opposite – to use segments or spaces that are of fixed position and fixed size.

And, as described in Section III.B, Jones does not appear to contemplate fixing the lower bound of a slidable window at a position at which short-lived data are expected to be stored.

Therefore, it follows that one skilled in the art would not find in Jones a suggestion to allow the dynamic expansion of an upper bound of a slidable window having a fixed lower bound.

D. Jones Does Not Teach or Suggest Alerting a Garbage Collector to the Storage of Data Expected to Quickly Become Garbage

In claimed embodiments of the present invention, a garbage collector is alerted when data are stored or are to be stored, if the data are expected to become garbage in a relatively short period of time.

The Examiner stated that Jones inherently teaches this as well. Applicant disagrees. Just because a garbage collector performs its garbage collection function does not mean that it receives clues about when or where short-lived data will be stored. And, because Jones does not appear to contemplate the use of a window that slides over a generation, Jones cannot inherently disclose using such a clue to alternate between one phase of memory allocation and garbage collection in which a lower bound of an expandable window is fixed, and a second phase in which the window slides.

To the contrary, Jones appears to inherently acknowledge that no such clue or alert is available. On page 144, lines 6-7, it is stated that “the lifetimes of objects cannot in general be determined statically.” The following paragraph discusses research showing that most objects die young. If Jones contemplated the use of clues regarding when short-lived data would be stored, some mention of such an idea would likely be found here.

Further, a section of Jones entitled “Object lifetimes” (pages 145-146) is also silent regarding alerting a garbage collector to the impending storage of data have a short life.

IV Selected Claims

A. Claims 1-10

No portion of Jones was cited against the preamble of claims 1 and 10, wherein the recited method is described as a method of performing garbage collection “using a dynamic slidable memory.” As described above in Section III.A, no part of Jones could be cited as disclosing this subject matter.

Nor was any portion of Jones cited for the limitations of “fixing a lower bound of a slidable window at said position, wherein said window is configured to identify a young generation within the memory” or “allowing an upper bound of said window to dynamically expand....” As discussed in Sections III.B and III.C, Jones does not disclose this subject matter, either inherently or explicitly.

Claim 2 recites the receipt of an alert before identifying the lower bound of the slidable window. As discussed in Section III.D, Jones does not contemplate notification of a garbage collector when short-lived data are to be stored.

Claim 9 makes it even clearer that the window identifying the young generation slides during one phase of allocation but is fixed during another phase. This reflects the two phases of operation described in the application.

B. Claims 11-20

Claims 11 and 20 were amended to include the subject matter of claim 13, which was cancelled. As described above in Section III.D, Jones does not contemplate receiving a notification regarding data having a finite or relatively short lifetime.

Claims 11 and 20 also recite the use of a young generation defined by a sliding window, fixing a lower bound of the window in a position and allowing the upper bound to expand. As described above in Sections III.A through III.C, Jones does not appear to disclose these limitations, either explicitly or inherently.

C. Claim 21

Claim 21 is directed to a data structure having an old generation area and young generation area defined by a slidable window. As the claim reads, during a normal phase of allocation of the data structure, the lower bound and the upper bound of the window slide. Jones does not disclose or imply use of a slidable window, as described above at Section III.A.

In a temporary phase of allocation, the lower bound is fixed in a position and the upper bound is allowed to dynamically expand. As described above in Sections III.B and III.C, Jones also does not appear to teach or suggest these limitations.

D. Claims 22-27

Claim 22 was amended to make it clearer that the memory can be allocated in two different phases of operation. In a normal phase, the window defining the young generation slides; in the temporary phase, the lower bound is fixed but the upper bound continues to expand.

As described above in Section III., Jones does not appear to contemplate the use of a slidable window, fixing the lower bound of a slidable window or allowing the upper bound of a slidable window to expand while the lower bound is fixed.

E. Claims 28-34

Claim 28 recites the use of a slidable window to define a young generation of memory. When a garbage collector is alerted to the storage of short-lived data, a lower bound of the slidable window is fixed in position but the upper bound is allowed to continue to expand. In response to the second alert, the lower bound is un-fixed and the slidable window can slide again.

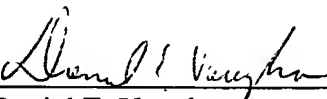
As described above in Section III, Jones does not appear to disclose or imply the use of a slidable window, fixing the lower bound of a slidable window, allowing the upper bound of a slidable window to expand while the lower bound is fixed or alerting a garbage collector to the storage of short-lived data.

CONCLUSION

No new matter has been added with the preceding amendments. It is submitted that the application is in suitable condition for allowance. Such action is respectfully requested. If prosecution of this application may be facilitated through a telephone interview, the Examiner is invited to contact Applicant's attorney identified below.

Respectfully submitted,

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